

TECHNICAL MEMORANDUM E-8

To: North Carolina Department of Environment and Natural Resources

ATTN: Larry Stanley, Hazardous Waste Section
Jackie Drummond, Solid Waste Section

FROM: Seaboard Group II and City of High Point

SUBJECT: Technical Memorandum No. E-8

Date: January 15, 2014

Seaboard Group II and City of High Point (Parties) hereby request that the Remedial Monitoring and Effectiveness Evaluation Plan (EEP), as included in the Remedial Action Preconstruction Report (PCR) as Attachment E, be revised as indicated in the attached document. After review by the Parties, it has been determined that the plan submitted with the PCR did not have the benefit of the data and information obtained since it was prepared. Therefore, some of the requirements were unnecessary, some were better addressed in a different manner, and some were not considered at all.

The Parties have prepared a revised EEP that takes into account this recent information, and modifies and expands the data collection and monitoring planned for the Site. It revises the groundwater and surface water monitoring to reflect the Randleman Reservoir having reached its normal pool, and collects water level data from additional locations, including from wells on properties north of the Site, to better monitor the capture zone for the contaminant plume.

The Parties respectfully request concurrence with this revised Remedial Monitoring and Effectiveness Evaluation Plan and modification to the Remedial Action Preconstruction Plan, Attachment E. If there are any questions, or if we may be of any assistance this matter, please feel free to contact Jim LaRue at (281) 431-3571 or Gary Babb at (919) 325-0696.

Respectfully,

Seaboard Group II and City of High Point



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Remedial Monitoring and Effectiveness Evaluation Plan

Seaboard Chemical Corporation & Riverdale Drive Landfill Site
Prepared for the Seaboard Group II and City of High Point

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1 INTRODUCTION

This Remedial Monitoring and Effectiveness Evaluation Plan (Plan) has been developed to monitor and assess the effectiveness of the approved groundwater and surface water remediation being conducted at the Seaboard Chemical Corporation and closed Riverdale Drive Landfill Site (Site) in Jamestown, Guilford County, North Carolina. This Plan supplements the Remedial Recommendation Document (Southwestern Environmental, 2005), the Remedial Action Preconstruction Report (ERM-NC, December 2009), and the revision and amendments thereto, that presents the remedial design installed to address impacted soils, groundwater, and surface water, and landfill leachate at the Site.

This Plan has been prepared by Seaboard Group II and the City of High Point (Parties) to replace the plan dated in October 2009, which is included as Attachment E in the Remedial Action Preconstruction Report, in order to reflect additional hydrogeologic and other information obtained since the 2009 plan was developed. The Preconstruction Report was submitted to the North Carolina Department of Environment and Natural Resources (NCDENR) in December 2009, and approved in April 2010.

1.1 BACKGROUND

The general Site location is shown in Figure 1. The Site consists of two properties as shown on Figure 2. The former Seaboard Chemical Corporation facility is located at 5899 Riverdale Drive, Jamestown, NC and consists of approximately 13 acres. The adjacent Riverdale Drive Landfill, a closed municipal solid waste landfill, consists of approximately 150 acres and bounds the Seaboard facility on two sides.

Between 1974 and 1989, Seaboard Chemical Corporation operated solvent recovery and fuel blending processes at the facility. The facility was granted Interim Status under the Resource Conservation and Recovery Act (RCRA) as a treatment, storage, and disposal facility in 1982. The facility was divided into 13 operating areas that included, among other things, distillation, fractionation, and condensation of organic solvent wastes. In addition, three surface impoundments were in service at the facility during the time that Seaboard was in operation. The corporation declared bankruptcy and was not able to fund the cost of performing the necessary Site closure and remediation.

Removal activities were conducted during 1990 and 1992 to remove all remaining waste materials and certain tanks and equipment from the Seaboard facility. The removal was conducted by the Seaboard Group I, formed by parties that may have used the services of Seaboard Chemical Corporation in the past (also referred to as potentially responsible parties or PRPs). The property is owned at this time by the bankruptcy estate of Seaboard Chemical Corporation.

The Landfill was operated, using customary methods in general use at the time, from the 1950's until October 1993. The Landfill was permitted by the NCDENR Solid Waste Section in 1979. During Landfill operations, sections of the two tributary streams that dissect the landfill property were piped, and solid waste was used to fill the drainage valleys. From approximately

1966 to 1970, Landfill operations included the disposal and open burning of spent solvents. Solvents were placed in open unlined pits referred to as burn pits. Periodically the burn pits were cleaned of residue that was accumulated in a mound. Presently this mound consists of approximately 600 cubic yards of contaminated residue and is referred to as the soil residue mound. In 1989, a leachate collection system was added to control surface seeps (leachate leakage) along the side-slopes of the landfill. The leachate from these seeps is presently collected in concrete storage tanks and subsequently pumped into tank trucks and treated off-site. The Landfill is now capped with a minimum of two feet of native soil and limited vegetative cover.

Seaboard Group II (Group) was formed to perform a remedial investigation and to prepare a remedial investigation report, baseline risk assessment, and feasibility study for the Seaboard site. The Group entered into an agreement with the City of High Point to perform a joint remedial investigation since the close proximity of the landfill and Seaboard Chemical Corporation facility made joint investigation of the two sites advantageous for both the City and the Group. The Parties then entered into an Administrative Order on Consent (AOC) dated January 30, 1996 with NCDENR to perform the remedial investigation. The feasibility study was conducted under a separate AOC dated July 22, 1997.

Remedial investigations conducted at the Site have documented the presence of chlorinated and non-chlorinated hydrocarbon compounds in soils, landfill leachate, groundwater, and surface water. The remedial investigation results indicate the presence of dense non-aqueous-phase liquid organics (DNAPL) in the fractured bedrock aquifer underlying the Site. The general area of impacted groundwater at the Site is shown on Figure 2.

The Remedy Recommendation Document dated February 2005 presents a protective remedial strategy for the impacted media based on the results of the remedial investigation, baseline risk assessment, and feasibility study. The proposed remedial design consists of groundwater extraction and treatment in combination with institutional controls including Site access control, recorded land use restrictions, and restriction of water supply well construction. The proposed remedy will prevent movement of contaminants into the Randleman Reservoir (Reservoir) and the Southern Intermittent Stream (SIS) and prevent exposure to impacted soils and groundwater at the Site. A network of seven groundwater recovery wells will be utilized for extraction of affected groundwater. In addition, seven leachate collection tanks will contain leachate leakage at the perimeter of the landfill. The locations of the recovery wells and leachate collection tanks are shown in Figure 4. Groundwater and surface water sampling will monitor the effectiveness of the remedy to ensure that there is no unacceptable migration of contaminants to the Reservoir.

It has been determined that the most effective long-term method to accomplish the treatment of the extracted groundwater is through natural treatment processes such as biodegradation and phytoremediation. This method will involve the use of an upland phytoremediation system comprised conifer and hardwood trees intended to provide year-around treatment effectiveness for the extracted groundwater. In addition, biodegradation of contaminants in the landfill soils will augment the treatment provided by the upland phytoremediation process.

1.2 OBJECTIVES

To the extent practical, the objectives of remedial action at the Site include the following:

1. Contain the contaminated soils at the source areas to prevent direct contact by potential human and environmental receptors, reduce percolation and intrusion of storm water and reduce migration of contaminants of concern (CoCs) into the groundwater; and,
2. Control migration of landfill leachate to prevent discharge to surface waters at the Site; and,
3. Control migration of contaminated groundwater and leachate at the Site to prevent offsite migration and unacceptable impacts to surface waters; and,
4. Achieve compliance with North Carolina surface water quality standards for the CoCs in the surface waters of the onsite streams and the Deep River; and,
5. Achieve compliance with North Carolina groundwater quality standards for the CoCs in the groundwater beneath the Site; and,
6. Restrict future Site uses that could present potentially unacceptable exposure risks (e.g., residential development, use of impacted groundwater, etc.).

2 MONITORING OBJECTIVES

The primary objectives of the groundwater and surface water-monitoring program are:

- Determine the general extent of the groundwater capture zones created by pumping each extraction well;
- Monitor volatile organic compound (VOC) concentrations and hydraulic containment of the VOC-affected groundwater at the Site;
- Monitor groundwater elevations, hydraulic gradients and flow directions;
- Measure the relative hydraulic gradient between groundwater and surface water at the Site;
- Monitor surface water quality in the Reservoir and Southern Intermittent Stream to assess potential impacts from VOC-affected groundwater discharge;
- Monitor and verify the general effectiveness of the groundwater and surface water remediation program.

3 REMEDIAL MONITORING PLAN

A groundwater and surface water-monitoring program has been developed to be conducted during the remedial action at the Site. The groundwater and surface water-monitoring program will be conducted commencing after the startup of the full remediation system. The proposed sampling and gauging locations are shown on Figure 4. The remedial monitoring plan is described below.

3.1 GROUND WATER MONITORING

Groundwater level gauging is proposed at 24 monitor wells (Figure 4) to monitor groundwater flow patterns at the Site and capture zones near the recovery wells during the remedial action. The water level measurements will be made manually using electronic water level meters on a quarterly basis for the initial two years and then annually thereafter.

In addition, seven monitor wells (PW-6D, OW-DR2, OW-DR3, OW-DR4, OW-LFS2, PW-15D, and PW-16D), as well as the primary extraction well (PWDR-1), will be equipped with automated water level pressure transducers to record groundwater level data on a daily basis year-around. The daily water level data will be collected at critical locations near recovery wells to monitor and document the capture zones of the groundwater extraction system.

Groundwater sampling is proposed at 24 monitoring wells (Figure 4) to track the VOC plume concentrations and containment. The groundwater samples will be analyzed for VOCs by EPA Method 8260 with 1,4-dioxane. Field parameters (pH, conductivity, dissolved oxygen, and temperature) will also be measured for each groundwater sample using calibrated meters. The sampling procedures will be in general accordance with the specifications provided in the project Sampling and Analysis Plan (ERM-NC, November 1995).

3.2 SURFACE WATER MONITORING

Surface water sampling is proposed on an annual basis at a total of six surface water stations (Figure 4). This will include two stations in the Reservoir, one upstream at the Kivett Drive Bridge, one in the Southern Intermittent Stream west of the former Seaboard site, one downstream on the Southern Intermittent Stream at the boundary with the Riverdale Drive Landfill, and one station on the Southern Intermittent Stream before it enters the Reservoir.

The surface water samples will be analyzed for VOCs, by EPA Method 8260 with 1,4-dioxane. Field parameters (pH, conductivity, dissolved oxygen, and temperature) will also be measured for each surface water sample using calibrated meters. The sampling procedures will be in general accordance with the specifications provided in the project Sampling and Analysis Plan (ERM-NC November 1995).

For the Randleman Reservoir sampling locations, two samples will be collected at each station:

- One sample at the surface of the water and
- One sample at approximately 1 foot above the bottom of the reservoir.

The deep reservoir sample will be collected using a subsurface grab sampling device (Kemmerer-style sampler or equivalent). The reservoir sampling locations are intended to be near the historical surface water sampling locations on the Deep River that were sampled during the remedial investigation at the Site and prior to the filling of the Randleman Reservoir. At the Northern Intermittent Stream (NIS) and SIS sample locations, a single grab sample will be collected at each location.

3.3 QUALITY CONTROL SAMPLES

Quality control samples will consist of a trip blank for analysis of volatile organic compounds

by EPA Method 8260 with 1,4-dioxane. The sampling procedures will be in general accordance with the specifications provided in the project Sampling and Analysis Plan.

3.4 MONITORING SCHEDULE

The groundwater and surface water-monitoring program will be conducted on an annual basis, or as the frequency may be revised, should a revised post-remediation plan be implemented.

4 EVALUATION OF EFFECTIVENESS OF REMEDIAL ACTION

The selected remedy includes using a network of groundwater extraction or recovery wells to intercept the main contaminant mass in groundwater at the Site in order to protect surface water quality in the Reservoir and the Southern Intermittent Stream. Currently, the remedial design of the recovery well system consists of seven shallow wells (40-50 feet deep) and one deep well (185 feet deep) to contain the affected groundwater. The design flow rate for the groundwater remediation system is 50-gallons per minute. The estimated duration of the remedial action is greater than 30-years.

The proposed remediation system is designed primarily to provide effective containment of the main contaminant mass in groundwater at the Site. The remedial approach will contain the migration of the VOC- affected groundwater to the surface water at the Site.

In order to confirm the effectiveness of the remediation system,

- 1) The remediation system will be monitored during a 2-year field performance test period upon startup of the system, and
- 2) The results of the groundwater and surface water-monitoring program described in Section 3.0 will be evaluated.

The objectives of the system effectiveness evaluation are:

- To determine the actual sustained flow (extraction) rates of each extraction well and the combined flow rate of the extraction system under prolonged pumping conditions, and
- Determine the effect on groundwater flow patterns and evaluate actual groundwater drawdown and capture zones generated by the extraction well network, and
- Evaluate the containment of the groundwater plume, and
- Evaluate the estimated the amount of contaminant mass extraction and the overall treatment system destruction and removal efficiency (DRE), and
- Evaluate the effectiveness of the remediation system for surface water remediation at the Site, and
- Determine the optimum operating parameters of the remediation system.

The major elements of the effectiveness evaluation of the remediation system are summarized in sections 4.1 through 4.4. However, this remedy is designed to provide containment of the contaminant plume and is not designed to achieve a specific amount of contaminant mass

removal. Rather it is designed to contain the plume while extracting as much of the contaminant mass as possible and removing as much of the mass before the effluent is used for irrigation. Additionally, the information from the monitoring program and effectiveness evaluation will be used to support a comprehensive five-year review of the overall protectiveness of the remedial action. The five-year review process is described in section 5.7.

4.1 MEASUREMENT OF EXTRACTION RATES OF RECOVERY WELLS

Groundwater flow (extraction) rates will be monitored by installed flow meters for each extraction well as part of the remedial monitoring program. The flow rate data will also be collected at regular intervals as part of the routine system operation activities (individual flows averaged over a 24 hour period as well as a record of the duration and flow rate of each extraction pump that operates). Each extraction well is equipped with a gate valve and totalizing flow meter in the discharge pipe to regulate and monitor flow rates and volumes.

4.2 EVALUATION OF GROUND WATER DRAWDOWN, CAPTURE ZONES AND FLOW PATTERNS

Throughout the 2-year performance test, and as part of the remedial monitoring program, water level data will be collected at regular time intervals by the system control and data acquisition (SCADA) for wells equipped with transducers and manually for other wells in the monitoring network. Water levels will be measured to the nearest 0.01 feet using transducers or electric water level indicators. During pumping, the water level data will be collected by the SCADA to measure drawdown in the recovery wells, and adjacent observation wells, during prolonged pumping conditions, and determine the effect of seasonal and climatological changes and variations in the pool elevation of the reservoir have on the groundwater and surface water flow as well as the overall capture zone at the Site. In analyzing the water level data the main goal will be to determine the extent of the capture zone for the extraction well system. To determine the properties of the capture zone, maps of maximum drawdown contours will be constructed in conjunction with the monitoring reports to reflect the effects of the capture zone.

Groundwater flow patterns during pumping will be determined by mapping monitored water level elevation data (as opposed to drawdown). The estimated capture zone boundaries and flow patterns will be compared to the previously determined plume boundaries to evaluate containment of the plume.

Immediately before the start of testing and the operation of the groundwater extraction system, pre-pumping water level data will be collected from the recovery wells, adjacent observation wells, and other wells in the monitoring network. The pre-pumping water-level data will be used to establish the static water levels that exist before the test.

4.3 EVALUATION OF RATES OF CONTAMINANT MASS RECOVERY

Even though groundwater extraction technology for contaminant removal and groundwater remediation has certain acknowledged limitations, contaminant mass removal rates will be calculated from the flow rate data and contaminant concentration data obtained by laboratory

analyses of the extracted groundwater, leachate and the process effluent water during system operation. Sampling and analysis of extracted groundwater and leachate for VOCs will be conducted at the LS-1 groundwater and leachate inlet pipe prior to the aeration tank during each annual sampling event during the 2-year performance test and as part of the remedial monitoring program. In addition, a sample of PWDR-1 and all other groundwater wells that pump directly into LS-2 and are not processed through LS-1 will be collected at their inlets into the wet-wall manifold in LS-2 before being pumped into the Filter Building aeration tank. These samples will be analyzed for VOCs by EPA Method 8260 with 1,4-dioxane. The data will be evaluated to calculate the amount of contaminant mass extracted by each recovery well. In addition, a sample of the remedial system effluent from the T-400 tanks in LS-2 will be collected to assess the DRE of the overall system.

4.4 OVERALL PERFORMANCE EVALUATION OF EXTRACTION WELL NETWORK

The effectiveness of the extraction well system will be evaluated based on the reduction of VOC contaminant concentrations in the surface waters of the reservoir and Southern Intermittent Stream, as well as the reduction of contaminant concentrations in groundwater at the monitoring wells located down-gradient of the recovery well network. In addition, the primary measure of the effectiveness of the system will be evaluated by containment of the groundwater plume and the calculated contaminant mass DRE of the mechanical treatment system.

During the 2-year test period, the Parties will conduct a pilot study on an instrumented phytoremediation pilot plot in existence at the Site. The goal of the pilot study will be to document and measure the effect that other natural treatment mechanisms, other than phytovolatilization, have on the contaminants of concern (CoC). This study will serve to better determine the extent of reduction of CoCs that can be expected from the natural treatment systems year-around. It is recognized that phytovolatilization is not as effective during seasons when tree uptake of water is minimal (respiration). However, in earlier pilot studies it was demonstrated by accurate mass balance using tracer additives that a significant of the eliminated 1,4-dioxane was not accounted for in tree uptake. One theory is that methane-metabolites active in the landfill soils cause accelerated biodegradation of the CoC, even at times of low tree uptake. At the conclusion of the 2-year test, the pilot study data should allow the determination of an overall DRE based on year-around efficiencies of both the physical and natural treatment systems.

4.5 DEVELOPMENT OF OPTIMUM SYSTEM OPERATING PARAMETERS

While operating the remediation system during the 2-year field performance test, adjustments to the system components will be made to optimize the system performance. The following operating parameters will be monitored, adjusted and recorded:

- Pumping rates of extraction wells.
- Collection of system operational data such as pressure, flow volumes, hours of operation, etc.
- Inspection of operational equipment and critical devices.

- Servicing of equipment as specified by the manufacturer.
- Repair and troubleshooting of the system as needed

Operational logs will be maintained to record critical data. The operational data obtained during the field performance test will be entered into a database and will serve as the baseline conditions for the system operation and performance. Adjustments for system optimization will be performed on an as needed basis as part of the routine operation and maintenance activities for the system.

4.6 ISSUES AND FOLLOW-UP ACTIONS

If a technical assessment of the monitoring data identifies conditions at the Site that significantly impact the effectiveness of the remediation system, then a plan of appropriate follow-up actions will be developed. Potential types of follow-up actions may include the following:

- Additional monitoring activities to confirm or supplement the routine monitoring data.
- Modifications to operation and maintenance activities of the remediation system to address the issue.
- Supplemental remedial assessment and/or risk assessment activities to further characterize the issue.
- Additional remedial measures (i.e. additional recovery wells or institutional controls) to address the issue. The plan of specific follow-up actions will be submitted to the NCDENR for review. The plan will include a schedule of implementation and reporting and the criteria that will be used to evaluate the effectiveness of the proposed action for achieving the remedial objectives.

4.7 COMPREHENSIVE FIVE-YEAR REVIEW

A comprehensive review of the remedy will be performed every five-years after NCDENR issues a letter to the parties authorizing operation of the remedy as built. The purpose of the five-year review is to evaluate the effectiveness of the remedy and to assess whether the remedy remains protective of human health and the environment. The scope of work of the five-year review will be in substantial compliance with the United States Environmental Protection Agency's (EPA's) Comprehensive Five-Year Review Guidance (OSWER Directive No. 9355.7-03B-P).

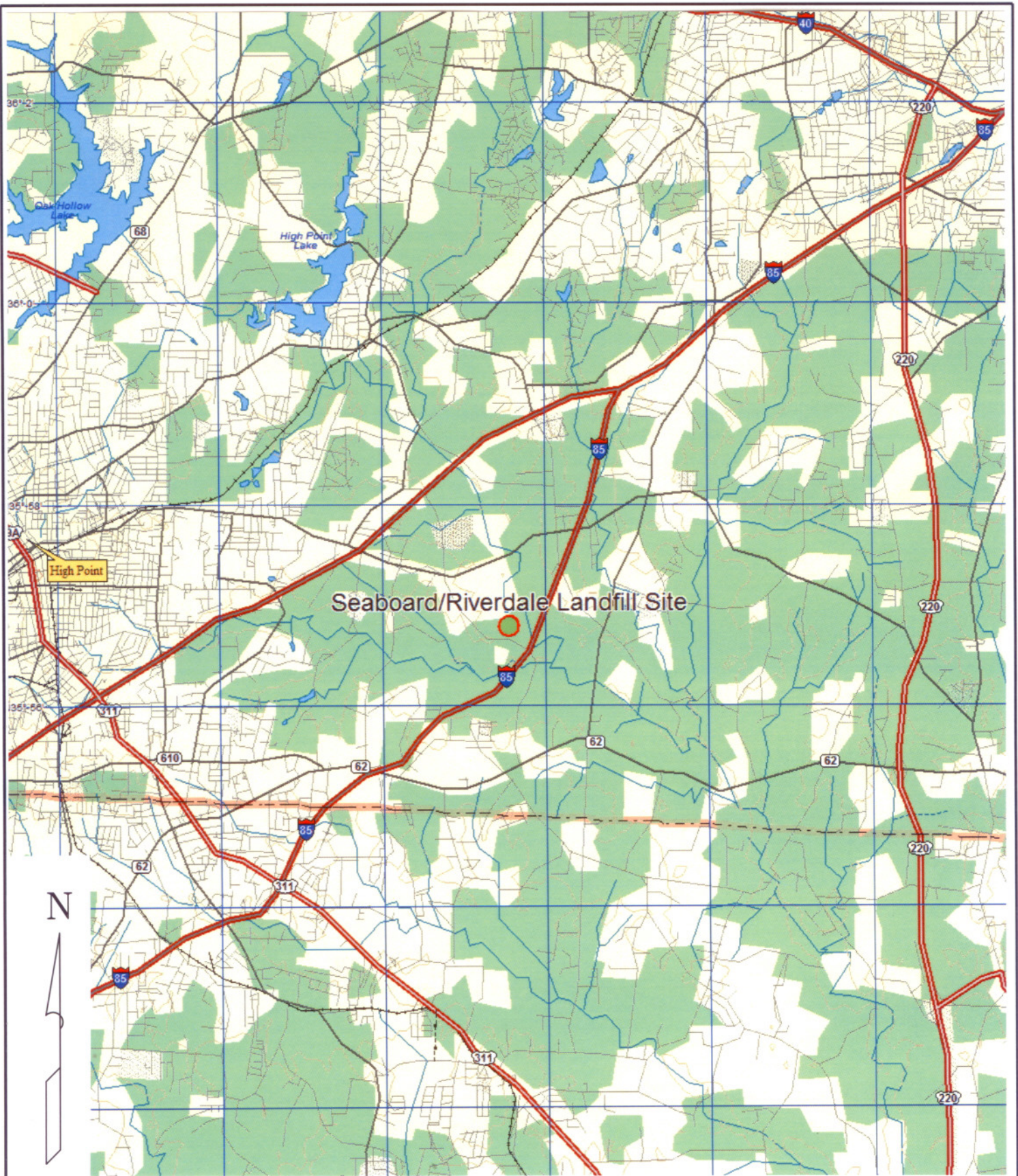
The five-year review will address the following three questions:

- Is the remedy functioning as intended in the design documents?
- Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?
- What is the effective DRE, mass removal rate and capture efficiency of the physical and natural treatment systems?
- Has any other information come to light that could call into question the protectiveness of the remedy?

In general, the scope of the five-year review will include the review of Site related documents (e.g. Ground Water Monitoring Reports) that have been submitted to the NCDENR since the last five-year review, a review of the Applicable or Relevant and Appropriate Regulations (ARARs) and a comparison to new standards, if any, and a Site technology review to address the operation of the remediation system and the performance of the Site remedy. The five-year review reports will be provided to NCDENR within one hundred and eighty (180) days of the end of each five-year reporting period; with the first five-year reporting period, commencing on the date the NCDENR issues a letter authorizing the system to be placed into operation.

5 REPORTING

The results of the groundwater and surface water monitoring activities will be presented in a report including data tables, laboratory reports, groundwater elevation contour maps and separate iso-concentration contour maps for total volatile organic compounds. The summary report will include a section presenting an evaluation of the effectiveness of the remedial action. The summary report will be submitted to the North Carolina Division of Waste Management no later than 90-days after all data is received, or 120-days after the samples are collected whichever is earlier.



Babb & Associates, P.A.

TITLE:

Site Location Map
Seaboard/Riverdale LF Site
Jamestown, North Carolina

FIGURE NO:

Figure 1

SCALE:

1" = 8000'

PROJECT NO:

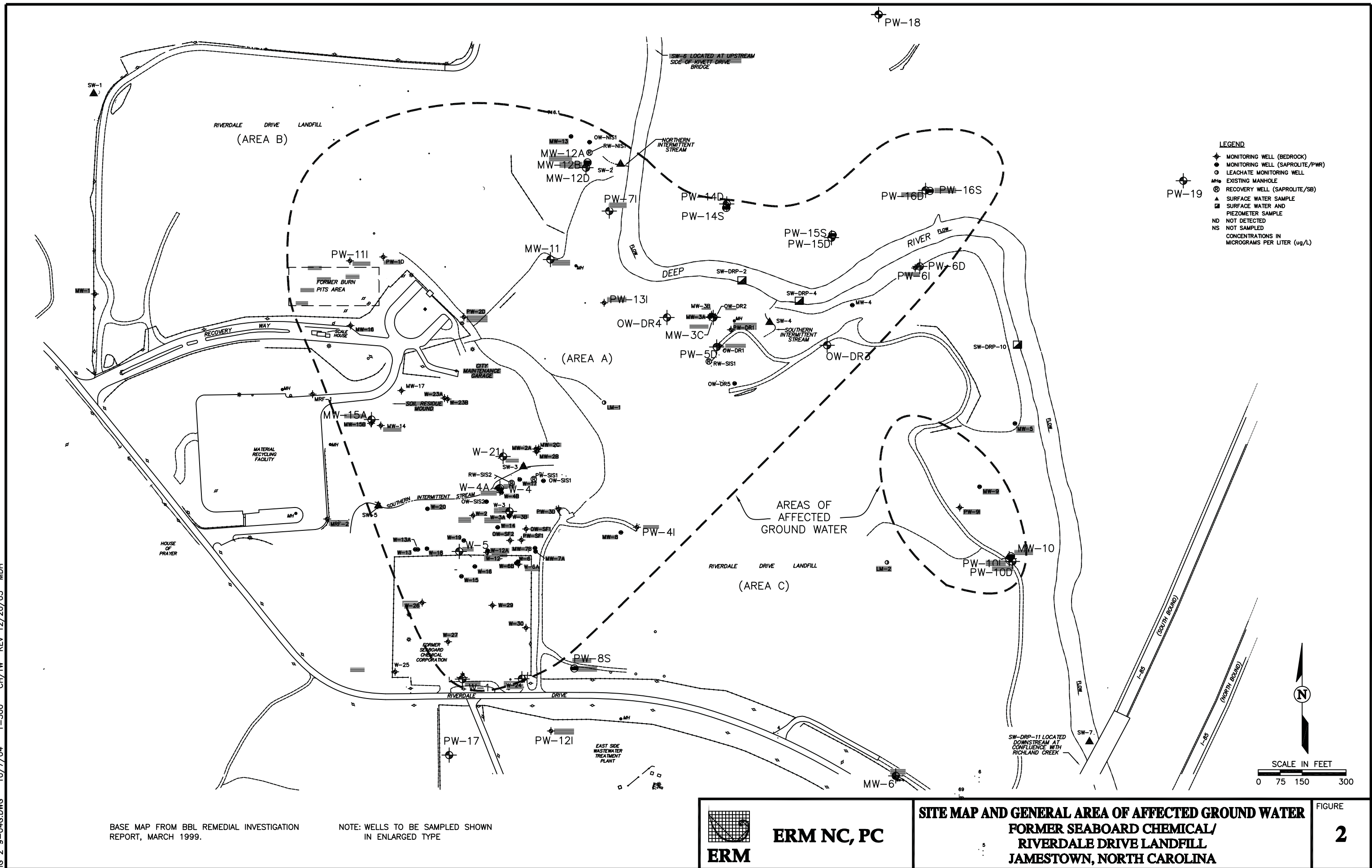
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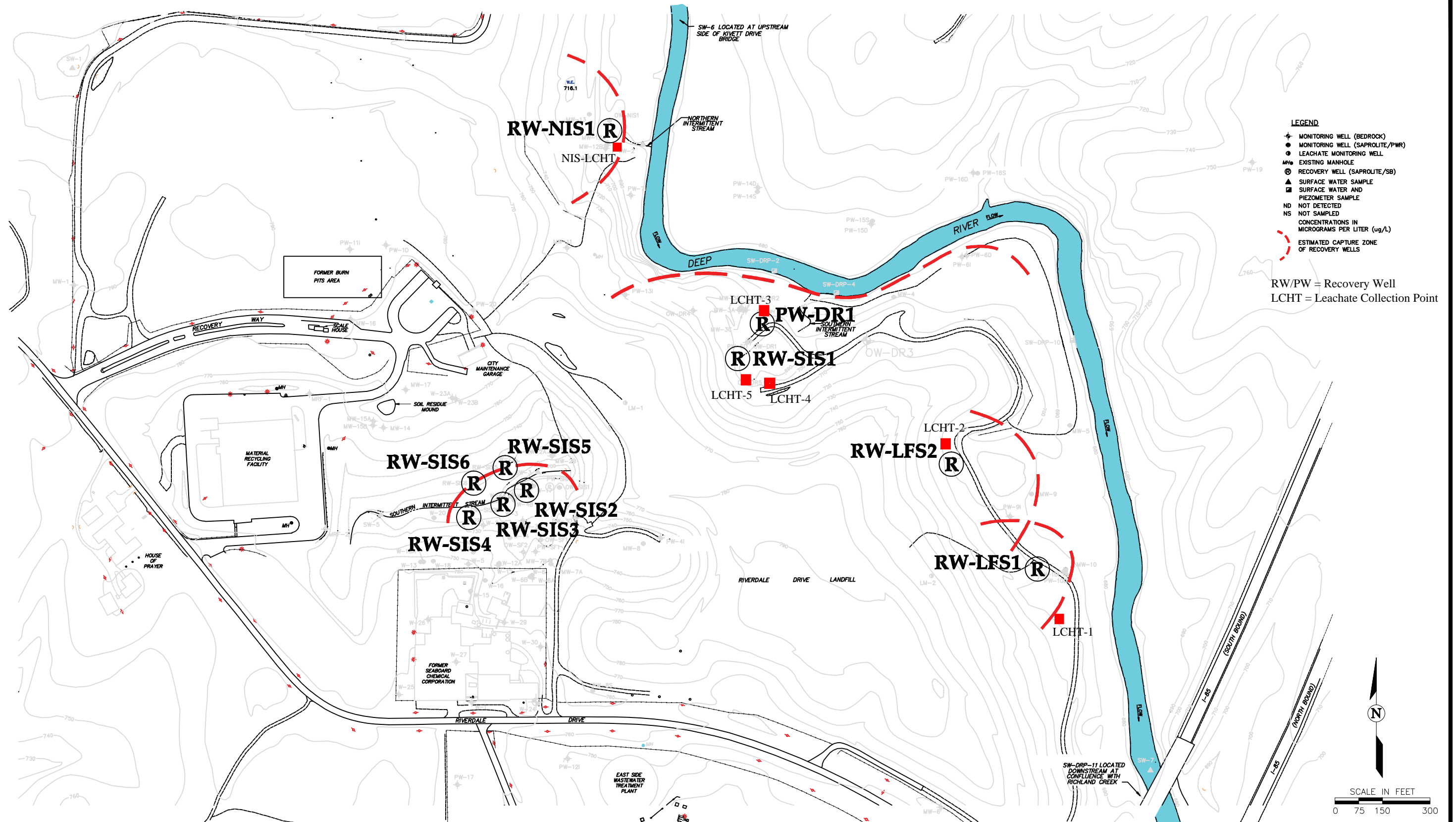
G. Babb

DATE:

2/10/11



29545PROP RECWELL LOC.DWG 6/14/05 1=1 CH/TW REV



- LEGEND**
- MONITORING WELL (BEDROCK)
 - MONITORING WELL (SAPROLITE/PWR)
 - LEACHATE MONITORING WELL
 - EXISTING MANHOLE
 - RECOVERY WELL (SAPROLITE/SB)
 - SURFACE WATER SAMPLE
 - SURFACE WATER AND PIEZOMETER SAMPLE
 - ND NOT DETECTED
 - NS NOT SAMPLED
 - CONCENTRATIONS IN MICROGRAMS PER LITER (ug/L)
 - ESTIMATED CAPTURE ZONE OF RECOVERY WELLS
- RW/PW = Recovery Well
LCHT = Leachate Collection Point

BASE MAP FROM BBL REMEDIAL INVESTIGATION
REPORT, MARCH 1999.



RECOVERY WELL LOCATIONS
FORMER SEABOARD CHEMICAL FACILITY/
RIVERDALE DRIVE LANDFILL SITE
JAMESTOWN, NORTH CAROLINA

